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Creating a Pathophysiological Model to Predict Blink Suppression Discomfort from Blink Timing

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Functional neuroimaging studies have attempted to explore brain activity that occurs with tic occurrence in subjects with Tourette syndrome (TS); however, they are limited by the difficulty of disambiguating brain activity required to perform a tic, or activity caused by the tic, from brain activity that generates a tic. Inhibiting the urge to tic is important to patients' experience of tics. We hypothesize that failure of inhibition of a compelling motor response to a natural urge, such as the urge to blink which shares many similarities to premonitory urges, will differ in TS subjects compared to controls. Previous neuroimaging studies with the same hypothesis have used a one-size-fits-all approach to extract brain signal putatively linked to the urge to blink. However, our objective was to create a subject-specific and blink-timing-specific pathophysiological model, derived from out-of-scanner blink suppression trials, in order to better interpret blink suppression fMRI data. Eye closure and continuously self-reported discomfort were reported during five blink suppression trials in 29 adult volunteers, 15 with a chronic tic disorder. The novel model of discomfort during blink suppression was a much better prediction of observed discomfort than previously tested models. The TS group blinked almost three times more often during the blink suppression block, and reported higher baseline discomfort, smaller excursion from baseline to peak discomfort during the blink suppression block, and slower return of discomfort to baseline during the recovery block. By accounting for blink timing and each subject's individual response characteristics, we were able to create a model which, using a leave-one-out cross-validation approach, was found to better reflect each subject's urge to blink compared to two previously proposed models. Combining this approach with observed eye closure during fMRI blink suppression trials should therefore extract brain signal more tightly linked to the urge to blink.